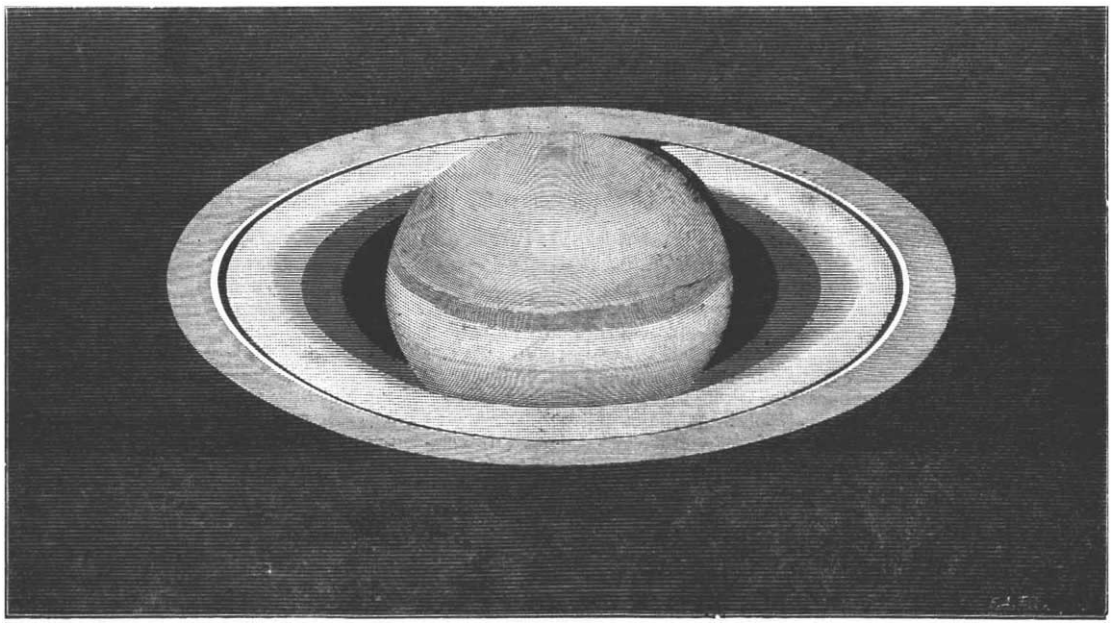
several nights were of exceptional purity so far as regards the definition of stars observed in the telescope. Messrs. Henry say :—

"We took advantage of the most favourable moments to observe with our refractor of 0·38 m. the aspect of the principal planets ; Saturn and his rings attracted our especial attention. The representations of this planet were often of remarkable precision, even when magnified more than a thousand times. It was possible to notice on several occasions curious inequalities in the equatorial band. Outside the known rings we established, around the principal separation (Cassini's division), the existence of a new ring, brilliant and perfectly defined, having a breadth of about $1\frac{1}{2}''$. It is surprising that this ring, which is quite visible, has not hitherto been perceived. But the fact which more particularly struck us in observing Saturn, and which has induced us to publish the accompanying sketch, is that, notwithstanding extremely favourable conditions of visibility, it was impossible to discover the least trace of the external *anse* (Encke's division). That division, indicated since Encke by all the observers who have published drawings of Saturn, and which we believe we had also seen with instruments of moderate power, may well be only the result of an optical illusion. This phenomenon would be produced, in our opinion, by the brilliant ring which we have discovered, and which irradiation causes to appear larger than it really is, while by an effect of contrast we believed we saw, like a black line of separation, what in reality is only a marked difference in the brightness of the rings. By examining at a distance of about three metres the sketch here given, this division may be very clearly noticed as it is usually represented. The experiment will succed even better if one takes the precaution of slightly closing the eyelids. In these conditions the aspect of the drawing is pretty much that which Saturn presents when observed with instruments of ordinary dimensions, or even with powerful telescopes when the definition is imperfect. We may then explain by an optical illusion these differences of aspect observed in the external ring, without its being necessary to attribute them to any modification which has taken place in this curious appendage of Saturn. This interesting planet is now too near the sun for useful observations to be practicable. We shall continue our researches by means of powerful telescopes at the next opposition."



Aspect of Saturn, March 4, 1884.

EARTH CURRENTS[1]

ONE of the most interesting subjects dealt with at the recent Electrical Congress in Paris was earth currents. The absence of published information in France on the behaviour of these erratic disturbers of telegraphic peace has led to an elaborate and careful study of the whole question by M. Blavier, the well-known and distinguished director of the High School of Telegraphy of the Post and Telegraph Administration in France. This has been printed, published, and circulated by the Minister of Posts and Telegraphs (M. Cochery) for the use of the members of the recent Congress.

These earth currents are always present in telegraph lines, varying in geographical and electrical direction and in strength, generally scarcely perceptible, but sometimes acquiring such intensity as to acquire the title of "storms." Their direction depends upon the direction of their earth terminals, and in no way on the route of the wires or on the fact of their being overground or underground. The longer the line the greater their strength. Their strength and direction vary with the hours of the day, and they show well-marked periods of maxima and minima. In fact there appears to be a tide in their affairs clearly following solar influence, and it has been believed by more than one observer that the influence of the moon is also perceptible. There is also an annual period of maximum and minimum, and this follows the well-marked eleven-year period of sunspots. We have just been passing through a period of maximum intensity. 1881 and 1882 were years of considerable activity. Their vagaries are exactly coincident

1 "Étude des Courants Telluriques," par E. E. Blavier. (Paris : Gauthier-Villars, 1884.)

with the variations of the mariner's compass, and are evidently primarily due to the same cause. It is when the aurora is present that they acquire extraordinary energy, and change their direction and intensity with great rapidity. Their effects are then observable simultaneously over the whole globe. They interfere seriously with the transmission of telegraph messages.

They have been studied and examined with great care in England. The eminent engineer, Mr. W. H. Barlow, F.R.S., was the first in the field, and his paper before the Royal Society in 1846 has scarcely been improved upon or added to. The late C. V. Walker was an incessant observer, and sent several papers to the Royal Society. Varley added considerably to our knowledge, and there are several papers by Mr. Preece, F.R.S., on their behaviour. The latter remarked that in the great storm of January 31, 1881, the currents acquired an electromotive force of ·3 volt per kilometre of earth surface and an intensity of 30 milliamperes—currents far stronger than those used for telegraphy. The *Proceedings of the Society of Telegraph Engineers* contain several interesting communications from Adams, Dresing, O. Walker, W. Ellis, Saunders, and others. It was warmly discussed at the Congress of 1881, which decided (1) that certain short lines in each country, independent of its general telegraph system, should be exclusively devoted to their study; (2) that long lines, particularly those underground, should be utilised as frequently as possible for the same purpose,—lines N. and S. and E. and W. being taken by preference, and one day per week—Sunday—being simultaneously employed for the purpose.

It was also suggested that during the year 1883 the 1st and 15th of each month should be taken for separate and careful observation. These resolutions have been faithfully carried out in Paris, and M. Blavier's work is the consequence. They have also been followed with great advantage in Germany and in Russia.

Permanent wires at right angles to each other have for many years been fixed and used in Greenwich, but the observations have not been systematically published, though the records are photographically printed.

M. Blavier has, since September 1883, organised a very careful system of automatic observation, by employing a clockwork apparatus similar to that designed by M. Mascart to register simultaneously the three components of terrestrial magnetism. He uses the dead-beat galvanometer of Deprez and d'Arsonval, shunted so as to meet the cases of all currents. As the chief point to be determined is the difference of potentials at the ends of a circuit, M. Blavier made the resistance of each long circuit examined equal to 10,000$^{\omega}$, and each short circuit 1000$^{\omega}$. The ordinates of the curve traced give indirectly the electromotive forces present. His excellent memoir contains a series of these curves, and very instructive they are. A complete lunar month from February 28 to March 28 is given. Observations were taken on aërial and underground wires. The general direction of maximum electromotive force in France is N.W.—S.E., making an angle of 56° with the magnetic meridian. M. Blavier concludes from the deflections of the needles that the disturbances of the magnetic elements are due to accidental electric currents circulating in the higher regions of the atmosphere although the earth currents circulate in the crust of the globe. He favours De la Rive's theory of the aurora borealis as being due to the circulation of electric currents in the higher regions of the atmosphere, in support of which he mentions several atmospheric effects well recorded as simultaneous with earth currents, such as intense scintillation of the stars observed by Montigny, and tempests. He associates earth currents with trade winds, and thereby indirectly with the sun.

Altogether M. Blavier's *brochure* is very ably written and a credit to the department of which he is such an old and distinguished member.

NOTES

THE French Minister of Education and the Fine Arts has proposed to place at the disposal of M. Pasteur, for the prosecution of his scientific experiments, a large domain situated at Villeneuve-Etang, which belongs to the State.

COLONEL DONNELLY has been appointed Secretary and permanent head of the Science and Art Department of the Privy Council.

THE Paris Academy of Sciences has nominated M. Cailletet, the inventor of the apparatus for the liquefaction of gas, a *Membre libre* in place of the late M. du Moncel. The Academy has appointed a Commission of six members to prepare a list of candidates for the office of Perpetual Secretary.

THE death is announced of M. Bontemps, the author of several volumes on pneumatic telegraphy, and engineer to the French Government for the construction of the Paris system.

A COMMITTEE has been formed at Alais (Gard) for erecting a statue in that city to M. Dumas. A committee will also be established for the erection of a statue to M. Wurtz in Paris.

THE election of Dr. C. S. Roy to the new Professorship of Pathology at Cambridge augurs well for the scientific development of the rapidly-increasing medical school of that University. Dr. Roy's work, both as George Henry Lewes Scholar and as Professor-Superintendent of the Brown Institution, has, it is well known, been of the highest merit and promise.

THE *conversazione* of the Institution of Civil Engineers takes place to-night at the South Kensington Museum.

WE are pleased to learn from a correspondent that the Natural History Department of the University of Edinburgh has undergone remarkable development during the last six months. Two years ago it had no lecture-room, and only one small room serving both as museum and laboratory. Now the old chemistry class-room, in which graduations and other ceremonials used to be held, and which is still the largest class-room in the University, has been handed over to the Professor of Natural History. There has not been time to have the class-room reseated, but the comfort of lecturer and students has been cared for in a still more important way, viz. by the erection of a ventilating fan, which changes the air several times every hour. The great demand for practical teaching which marked Prof. Ewart's advent to Edinburgh could only then be met with by resorting to a remote corner of the College buildings. Now the practical work is carried on in a splendid, beautifully decorated, well-lighted hall—a dingy museum in Jameson's time, but now capable of accommodating about 130 men at a time. In addition to this laboratory there is an adjacent smaller work-room for advanced students. A series of tanks is in process of erection in the lower room, which corresponds in size to the large laboratory, and which it is intended to convert into a laboratory provided with all the necessary apparatus for studying the life-history and development of marine organisms. When the other rooms which formerly belonged to the Natural History Department are added, the arrangements for teaching zoology in Edinburgh will be alike complete and satisfactory.

WE understand that the University of St. Andrew is about to approach the Government with the view of obtaining funds for extending the Natural History Museum and at the same time for providing a marine laboratory within the walls of the University, while the more practical work of hatching, &c., which the Fishery Board for Scotland is carrying on will be provided for